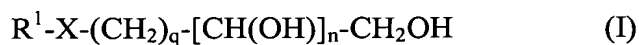


## AMENDMENTS TO THE CLAIMS

Claim 1 (Original): A polishing liquid composition for polishing a surface to be polished comprising an insulating layer and a metal layer, the polishing liquid composition comprising a compound having a structure in which each of two or more adjacent carbon atoms has a hydroxyl group in a molecule, and water, wherein the compound having a structure in which each of two or more adjacent carbon atoms has a hydroxyl group in a molecule is represented by the formula (I):



wherein

$R^1$  is a hydrocarbon group having 1 to 24 carbon atoms;

X is a group represented by

$(CH_2)_m$ , wherein m is 1,

oxygen atom,

sulfur atom,

COO group,

OCO group,

a group represented by  $NR^2$  or

$O(R^2O)P(O)O$ , wherein  $R^2$  is hydrogen atom or a hydrocarbon group having 1 to 24 carbon atoms;

q is 0 or 1; and

n is an integer of 1 to 4.

Claim 2 (Original): The polishing liquid composition according to claim 1, further comprising an organic acid.

Claim 3 (Original): The polishing liquid composition according to claim 2, wherein the organic acid is an etching agent.

Claim 4 (Original): The polishing liquid composition according to claim 1, further comprising an etching agent comprising an inorganic acid.

Claim 5 (Previously Presented): A polishing liquid composition for polishing a surface to be polished comprising an insulating layer and a metal layer, the polishing liquid composition comprising an aliphatic carboxylic acid having 7 to 24 carbon atoms and/or a salt thereof, an etching agent comprising an organic acid, and water, wherein

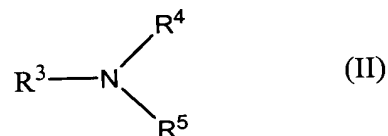
the organic acid of the etching agent is at least one selected from the group consisting of

- A: aliphatic organic acids having 6 or less carbon atoms and one to three carboxyl groups;
- B: aromatic organic acids having 7 to 10 carbon atoms and one to four carboxyl groups;
- C: organic acids having 6 or less carbon atoms and one to four phosphonic groups; and
- D: polyaminocarboxylic acids having in a molecule two or more structures represented by the formula (III):



Claim 6 (Previously Presented): A polishing liquid composition for polishing a surface to be polished comprising an insulating layer and a metal layer, the polishing liquid composition comprising

an amine compound represented by the following general formula (II):



wherein

$\text{R}^3$  is a linear or branched alkyl group having 4 to 18 carbon atoms,  
a linear or branched alkenyl group having 4 to 18 carbon atoms,  
an aryl group having 6 to 18 carbon atoms, and  
an aralkyl group having 7 to 18 carbon atoms;

each of  $\text{R}^4$  and  $\text{R}^5$ , which may be identical or different, is

a linear alkyl group having 1 to 8 carbon atoms or

a branched alkyl group having 3 to 8 carbon atoms, or

a group represented by  $\text{H}-(\text{OR}^6)_Z$ , wherein  $\text{R}^6$  is a linear alkylene

group having 1 to 3 carbon atoms, or

a branched alkylene group having 3 carbon atoms; and

$Z$  is a number of 1 to 20, and/or a salt thereof,

an etching agent,

an oxidizing agent, and

water.

Claim 7 (Previously Presented): The polishing liquid composition according to Claim 1, further comprising an oxidizing agent, an abrasive or a mixture thereof.

Claim 8 (Canceled)

Claim 9 (Withdrawn - Previously Presented): A method of using a polishing liquid composition, the method comprising polishing a surface using the polishing liquid composition of Claim 1.

Claim 10 (Canceled)

Claim 11 (Previously Presented): The polishing liquid composition according to claim 2, further comprising an oxidizing agent, an abrasive or a mixture thereof.

Claim 12 (Previously Presented): The polishing liquid composition according to claim 5, further comprising an oxidizing agent, an abrasive or a mixture thereof.

Claim 13 (Previously Presented): The polishing liquid composition according to claim 6, further comprising an oxidizing agent, an abrasive or a mixture thereof.

Claim14 (Withdrawn – Previously Presented): A method of using a polishing liquid composition, the method comprising polishing a surface using the polishing liquid composition of claim 2.

Claim 15 (Withdrawn – Previously Presented): A method of using a polishing liquid composition, the method comprising polishing a surface using the polishing liquid composition of claim 5.

Claim 16 (Withdrawn – Previously Presented): A method of using a polishing liquid composition, the method comprising polishing a surface using the polishing liquid composition of claim 6.

Claim 17 (Withdrawn – Previously Presented): A method of using a polishing liquid composition, the method comprising polishing a surface using the polishing liquid composition of claim 7.

Claim 18 (Withdrawn – Previously Presented): A method of using a polishing liquid composition, the method comprising polishing a surface using the polishing liquid composition of claim 11.

Claim 19 (Withdrawn – Previously Presented): A method of using a polishing liquid composition, the method comprising polishing a surface using the polishing liquid composition of claim 12.

Claim 20 (Withdrawn – Previously Presented): A method of using a polishing liquid composition, the method comprising polishing a surface using the polishing liquid composition of claim 13.

Claims 21-27 (Canceled)

Claim 28 (Withdrawn – Previously Presented) A method of making a polishing liquid composition, the method comprising  
mixing water and a compound having a molecular structure in which each of two or more adjacent carbon atoms has a hydroxyl group; and  
producing the polishing liquid composition of claim 1.

Claim 29 (Withdrawn – Previously Presented) A method of making a polishing liquid composition, the method comprising  
mixing an aliphatic carboxylic acid having 7 to 24 carbon atoms and/or a salt thereof, an etching agent, an oxidizing agent and water; and  
producing the polishing liquid composition of claim 5.

Claim 30 (Withdrawn – Previously Presented) A method of making a polishing liquid composition, the method comprising  
mixing an amine compound, an etching agent, an oxidizing agent and water; and  
producing the polishing liquid composition of claim 6.

Claim 31 (New): A polishing liquid composition for polishing a surface to be polished comprising an insulating layer and a metal layer, the polishing liquid composition comprising an aliphatic carboxylic acid having 7 to 24 carbon atoms and/or a salt thereof, an etching agent comprising an organic acid, and water, wherein

the organic acid of the etching agent is at least one selected from the group consisting of

- A: aliphatic organic acids selected from the group consisting of formic acid, propionic acid, tricarballic acid, 2-hydroxypropionic acid, gluconic acid, and amino acids;
- B: aromatic organic acids having 7 to 10 carbon atoms and one to four carboxyl groups;
- C: organic acids having 6 or less carbon atoms and one to four phosphonic groups; and
- D: polyaminocarboxylic acids having in a molecule two or more structures represented by the formula (III):



Claim 32 (New): A polishing liquid composition for polishing a surface to be polished comprising an insulating layer and a metal layer, the polishing liquid composition comprising an aliphatic carboxylic acid having 7 to 24 carbon atoms and/or a salt thereof, an etching agent comprising an organic acid, and water, wherein

the organic acid of the etching agent is at least one selected from the group consisting of

- B: aromatic organic acids having 7 to 10 carbon atoms and one to four carboxyl groups;
- C: organic acids having 6 or less carbon atoms and one to four phosphonic groups; and
- D: polyaminocarboxylic acids having in a molecule two or more structures represented by the formula (III):





### SUPPORT FOR THE AMENDMENT

This Amendment adds new Claims 31-32. Support for the amendments is found in the specification and claims as originally filed. In particular, support for new Claim 31 is found in Claim 5 and in the specification at least at page 15, lines 1-8. Support for new Claim 32 is found in Claim 5. No new matter would be introduced by entry of these amendments.

Upon entry of these amendments, Claims 1-7, 9, 11-20 and 28-32 will be pending in this application. Claims 1, 5, 6 and 31-32 are independent. Claims 9, 14-20 and 28-30 are withdrawn from consideration.

### REQUEST FOR RECONSIDERATION

Applicants respectfully request entry of the foregoing and reexamination and reconsideration of the application, as amended, in light of the remarks that follow.

Applicants thank the Examiner for the courtesies extended to their representative during the May 12, 2004, personal interview.

As discussed at the personal interviews, the present invention provides polishing liquid compositions that, when used to polish a surface comprising an insulating layer and a metal layer, prevents the occurrence of dishing.

Claims 1-3, 7 and 11 are rejected under 35 U.S.C. § 103(a) over U.S. Patent No. 6,383,240 ("Nishimoto"). Applicants respectfully traverse the rejection because Nishimoto is not prior art to the above-identified application. Nishimoto was filed on September 29, 2000. In contrast, the effective U.S. filing date of the above-identified national stage application is the international filing date of July 7, 2000. See, e.g., M.P.E.P. at page 700-21, column 2; and § 1893.03(b). Because Nishimoto was filed after the effective U.S. filing date of the

above-identified application, Nishimoto is not prior art to the above-identified application.

Thus, the rejection over Nishimoto should be withdrawn.

Claims 5 and 12 are rejected under 35 U.S.C. § 102(b) over U.S. Patent No. 5,783,489 ("Kaufman-489"). Kaufman-489 discloses a chemical mechanical polishing (CMP) slurry comprising at least two oxidizing agents, an organic acid and an abrasive. Kaufman-489 at abstract. Kaufmann-489 discloses:

The CMP slurry of this invention includes an organic acid. A wide range of conventional organic acids, salts of organic acids, and mixtures thereof are useful in the CMP slurry of the present invention to enhance the selectivity to oxide polishing rate, such as monofunctional acids, di-functional acids, hydroxyl/carboxylate acids, chelating, non-chelating acids, and their salts. Preferably, the organic acid is selected from the group of acetic acid<sup>\*2</sup>, adipic acid<sup>\*2</sup>, butyric acid<sup>\*2</sup>, capric acid<sup>\*1</sup>, caproic acid<sup>\*2</sup>, caprylic acid<sup>\*1</sup>, citric acid<sup>\*2</sup>, glutaric acid<sup>\*2</sup>, glycolic acid<sup>\*2</sup>, formic acid<sup>\*2</sup>, fumaric acid<sup>\*2</sup>, lactic acid<sup>\*2</sup>, lauric acid<sup>\*1</sup>, malic acid<sup>\*2</sup>, maleic acid<sup>\*2</sup>, malonic acid<sup>\*2</sup>, myristic acid<sup>\*1</sup>, oxalic acid<sup>\*2</sup>, palmitic acid<sup>\*1</sup>, phthalic acid<sup>\*2</sup>, propionic acid<sup>\*2</sup>, pyruvic acid<sup>\*2</sup>, stearic acid<sup>\*1</sup>, succinic acid<sup>\*2</sup>, tartaric acid<sup>\*2</sup>, valeric acid<sup>\*2</sup> and derivatives, including salts thereof.

The organic acid or salt should be present in the final CMP slurry, individually or in combination with other organic acids or salts, in an amount sufficient to enhance the oxide selectivity without detrimentally effecting the stability of the CMP slurry. Kaufmann-489 at column 6, lines 1-19 (umbered asterisks added).

In the passage above, an acid designated \*1 belongs to independent Claim 5's aliphatic carboxylic acids having 7 to 24 carbon atoms and an acid designated \*2 belongs to Claim 5's etching agent.

However, Kaufmann-489 fails to disclose or exemplify the specific combination of acids of independent Claim 5 of an (i) aliphatic carboxylic acid having 7 to 24 carbon atoms and/or a salt thereof and (ii) the recited etching agent. Claim 5's acids synergistically combine to maintain a practical polishing speed while avoiding excessive etching of a metal layer, which leads to undesirable dishing. See, e.g., specification at page 18, lines 1-10. Given the large number of acid combinations possible from Kaufman-489's list of acids, there is no reasonable expectation that Kaufman-489 would successfully lead the skilled artisan to

the Claim 5 combination of acids (i) and (ii) necessary to both maintain polishing speed and prevent dishing. A system of glycolic acid and citric acid, both of which belong to the Claim 5 group (ii) of etching agents and appear in Kaufman-489's list of acids, fails to prevent dishing. See, Comparative Example II-6 in the specification at Table 4, reproduced below. Since Kaufman-489 fails to suggest all the limitations of independent Claim 5, the rejection under 35 U.S.C. § 102(b) over Kaufman-489 should be withdrawn.

Any *prima facie* case for the obviousness of independent Claim 5 is rebutted by the significant reduction in dishing achieved by Claim 5's specific combination of (i) "an aliphatic carboxylic acid having 7 to 24 carbon atoms and/or a salt thereof" and (ii) "an etching agent comprising an organic acid" from the recited Markush group. See the Examples and Comparative Examples of Tables 3 and 4, which are reproduced below.

Table 3

Ex. No.	Aliphatic Carboxylic Acid and/or Its Salt		Etching Agent		Hydrogen Peroxide	Abrasive	pH
	Kind	Content	Kind	Content			
II-1	Octanoic acid	0.6 <sup>1)</sup>	Glycolic acid	2.0 <sup>1)</sup>	4.0 <sup>1)</sup>	Colloidal Silica	7.6
II-2	Nonanoic acid	0.3	Glycolic acid	2.0	4.0	Colloidal Silica	7.7
II-3	Heptanoic acid	1.2	Glycolic acid	2.0	4.0	Colloidal Silica	7.6
II-4	Decanoic acid	0.3	Glycolic acid	2.0	4.0	Colloidal Silica	7.7
II-5	Oleic acid	0.3	Glycolic acid	2.0	4.0	Colloidal Silica	8.0
II-6	Isooctanoic acid <sup>2)</sup>	1.5	Glycolic acid	2.0	4.0	Colloidal Silica	7.7
II-7	Octanoic acid	1.2	Citric acid	2.0	2.0	Fumed Silica	7.6
II-8	Octanoic acid	1.0	Phthalic acid	2.0	2.0	Fumed Silica	7.9
II-9	Octanoic acid	1.5	Aminotri-(methylene-phosphonic acid)	2.0	2.0	Fumed Silica	7.6
II-10	Octanoic acid	0.4	Glycolic acid	2.0	—	Colloidal Silica	7.6
II-11	Octanoic acid	1.0	Hydrochloric acid	2.0	2.0	Colloidal Silica	7.7
II-12	Octanoic acid	0.5	Sulfuric acid	2.0	2.0	Colloidal Silica	7.9

— Continued —

— Continued —

Ex. No.	Evaluation for Properties				
	Relative Polishing Speed	Relative Etching Speed	Comp. Ex. To Which Evaluation Was Based	Dishing	Copper Surface Condition
II-1	1.0	0.1 or less	Comp. Ex. II-1	Absence	No Roughening
II-2	1.0	0.1 or less	Comp. Ex. II-1	Absence	No Roughening
II-3	1.0	0.1 or less	Comp. Ex. II-1	Absence	No Roughening
II-4	0.9	0.1 or less	Comp. Ex. II-1	Absence	No Roughening
II-5	0.9	0.1 or less	Comp. Ex. II-1	Absence	No Roughening
II-6	1.0	0.1 or less	Comp. Ex. II-1	Absence	No Roughening
II-7	1.0	0.1 or less	Comp. Ex. II-2	Absence	No Roughening
II-8	0.9	0.1 or less	Comp. Ex. II-3	Absence	No Roughening
II-9	0.9	0.1 or less	Comp. Ex. II-4	Absence	No Roughening
II-10	0.9	0.1 or less	Comp. Ex. II-5	Absence	No Roughening
II-11	0.9	0.1 or less	Comp. Ex. II-11	Absence	No Roughening
II-12	0.9	0.1 or less	Comp. Ex. II-12	Absence	No Roughening

Note 1): % by weight

2): Secanoic C8 acid (trade name, commercially available from Exxon Chemicals K.K.)

Table 4

Comp. Ex. No.	Aliphatic Carboxylic Acid and/or Its Salt		Etching Agent		Hydrogen Peroxide	Abrasive	pH
	Kind	Content	Kind	Content	Content	Kind	
II-1	-	-	Glycolic acid	2.0 <sup>1)</sup>	4.0 <sup>1)</sup>	Colloidal Silica	7.6
II-2	-	-	Citric acid	2.0	2.0	Fumed Silica	7.6
II-3	-	-	Phthalic acid	2.0	2.0	Fumed Silica	7.9
II-4	-	-	Aminotri-(methylene-phosphonic acid)	2.0	2.0	Fumed Silica	7.6
II-5	-	-	Glycolic acid	2.0	-	Colloidal Silica	7.6
II-6	-	-	Glycolic acid	1.0	4.0	Colloidal Silica	7.6
II-7	Octanoic acid	0.5 <sup>1)</sup>	-	-	4.0	Colloidal Silica	7.8
	Heptanoic acid	0.5					
II-8	Oleic acid	0.5	-	-	4.0	Colloidal Silica	7.6
II-9	Benzo-triazole	0.3	Glycolic acid	2.0	4.0	Colloidal Silica	7.6
II-10	Ammonium Poly-acrylate	1.0	Citric acid	2.0	2.0	Fumed Silica	7.6
II-11	-	-	Hydrochloric acid	2.0	2.0	Colloidal Silica	7.7
II-12	-	-	Sulfuric acid	2.0	2.0	Colloidal Silica	7.9

- Continued -

- Continued -

Comp. Ex. No.	Evaluation for Properties					Copper Surface Condition
	Relative Polishing Speed	Relative Etching Speed	Comp. Ex. To Which Evaluation Was Based	Dishing		
II-1	1.0	1.0	-	Presence	No Roughening	
II-2	1.0	1.0	-	Presence	No Roughening	
II-3	1.0	1.0	-	Presence	No Roughening	
II-4	1.0	1.0	-	Presence	No Roughening	
II-5	1.0	1.0	-	Presence	No Roughening	
II-6	1.3	1.5	Comp. Ex. II-1	Presence	No Roughening	
II-7	0.1 or less	0.1 or less	Comp. Ex. II-1	The polishing speed was too slow to be evaluated.		
II-8	0.1 or less	0.1 or less	Comp. Ex. II-1			
II-9	0.1 or less	0.1 or less	Comp. Ex. II-1			
II-10	1.2	0.1 or less	Comp. Ex. II-2	Absence	Presence of Roughening	
II-11	1.0	1.0	-	Presence	No Roughening	
II-12	1.0	1.0	-	Presence	No Roughening	

Note 1): % by weight

Because Kaufman-489 fails to suggest the significant reduction in dishing achieved by independent Claim 5's specific combination of (i) "an aliphatic carboxylic acid having 7 to 24 carbon atoms and/or a salt thereof" and (ii) "an etching agent comprising an organic acid" from the recited Markush group, any *prima facie* case of obviousness based on Kaufman-489 is rebutted. Thus, Kaufman-489 fails to have rendered obvious independent Claim 5.

Claims 6 and 13 are rejected under 35 U.S.C. § 102(e) over U.S. Patent No. 6,063,306 ("Kaufman-306"). Kaufman-306 discloses a chemical mechanical polishing slurry that can include an organic amino compound such as nonylamine and dodecylamine. Kaufman-306 at column 6, lines 12-13. However, the singly substituted alkylamines of Kaufman-306 (see definitions of "nonylamine" and "dodecylamine" in Handbook of Chemistry and Physics, 52d edition, pages C-274 and C-394, copies attached) fail to suggest the triply substituted amine compound of independent Claim 6. Thus, the rejection over Kaufman-306 should be withdrawn.

Pursuant to M.P.E.P. § 821.04, after independent product Claims 1, 5 and 6 are allowed, Applicants respectfully request rejoinder, examination and allowance of withdrawn method Claims 9, 14-20 and 28-30, which include all of the limitations of independent product Claims 1, 5 and 6, respectively.

In view of the foregoing amendment and remarks, Applicants respectfully submit that the application is in condition for allowance. Applicants respectfully request favorable consideration and prompt allowance of the application.

Should the Examiner believe that anything further is necessary in order to place the application in even better condition for allowance, the Examiner is invited to contact Applicants' undersigned attorney at the telephone number listed below.

Respectfully submitted,

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Attachments:

Handbook of Chemistry and Physics, 52d edition, pages C-274 and C-394

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(OSMMN 08/03)

## PHYSICAL CONSTANTS OF ORGANIC COMPOUNDS (Continued)

No.	Name	Synonyms and Formula	Mol. wt.	Color, crystalline form, specific rotation and $\lambda_{max}$ (log $\epsilon$ )	m.p. °C	b.p. °C	Density	$n_D$	Solubility						Ref.
									w	al	eth	ace	bz	other solvents	
d263	<b>Disulfide</b> —di-2-tolyl		246.40	lf (al) $\lambda^a$ 240 (4.21), 280 (3.45), 325 sh (2.95)	38–9				i	s	s	s		os s	B6 <sup>2</sup> , 342
d264	—di-4-tolyl		246.40	nd or lf (al) $\lambda^a$ 242 (4.29), 270 (3.65), 315 sh (3.2)	47–8	210–15 <sup>20</sup>	1.114 <sup>51</sup>		i	s	v	s			B6 <sup>2</sup> , 400
—Ditane	see Echitamine														
—Ditan	see Methane, diphenyl-														
Ω d265	1,4-Dithiane	Diethylene disulfide	120.25	mcl pr $\lambda^a$ 225 sh (2.54), 292 (2.5)	111–2	199–200			$\delta^a$	$s^b$	s			CS <sub>2</sub> s aa s <sup>a</sup>	B19 <sup>2</sup> , 6
d266	1,3,5-Dithiazine, 4,5-dihydro-5-methyl-	Methylthioformaldine	135.25	nd (eth)	65	ca. 185d				s	s			aa s	B27, 460
d267	1,4-Dithiane, 2,5-diphenyl-		268.40	ye pr (al) $\lambda$ 260 (4.35), 308 (3.95)	118–9				i	s			v	con sulfs alk s	B19 <sup>2</sup> , 46
—Dithioacetic acid	see Acetic acid, thionothio-														
d268	1,3-Dithiolane	Trimethylene 1,3-disulfide	106.21	$\lambda^{xy}$ 207 (3.13), 247 (2.56)	–51	175 <sup>760</sup>	1.259 <sup>17</sup>	1.5975 <sup>15</sup>		s	s			xyl s	B19 <sup>2</sup> , 3
Ω d269	Dithizone	Diphenylthiocarbazone. Formazyl mercaptan. C <sub>6</sub> H <sub>5</sub> N <sub>2</sub> NCSNHNHC <sub>6</sub> H <sub>5</sub>	256.33	bl-bk (chl-al) $\lambda^{***}$ 445 (4.29), 610 (4.51)	165–9d				i	$\delta$	$\delta$			chl. alk s	B16, 26
d270	Diurea	Dicarbamide. <i>p</i> -Urazine.	116.08	pr (w)	270				$\delta^a$	$\delta$				aa $\delta$	B26 <sup>2</sup> , 258
—Divarinol	see Benzene, 1,3-dihydroxy-5-propyl-								$s^a$					dil ac s dil alk s	B4 <sup>3</sup> , 1591
Ω d271	Djenkolic acid	$\beta$ , $\beta'$ -Methylenedithiodialanine. HO <sub>2</sub> CCH(NH <sub>2</sub> )CH <sub>2</sub> SCH <sub>2</sub> SCH <sub>2</sub> CH(NH <sub>2</sub> )CO <sub>2</sub> H	254.33	nd (w. HCl) $[\alpha]_D^{25}$ –47.5 (1% HCl, c = 2)	300–50d										
Ω d272	Docosane*	CH <sub>3</sub> (CH <sub>2</sub> ) <sub>20</sub> CH <sub>3</sub>	310.61	pl (to), cr (eth)	44.4	368.6 <sup>760</sup> 213 <sup>10</sup> 306 <sup>90</sup>	0.7944 <sup>20</sup>	1.4455 <sup>20</sup>	i	$s^a$	v			chl s	B1 <sup>3</sup> , 574
Ω d273	Docosanoic acid*	Behenic acid. Docosoic acid. CH <sub>3</sub> (CH <sub>2</sub> ) <sub>20</sub> CO <sub>2</sub> H	340.60	nd	80		0.8223 <sup>90</sup>	1.4270 <sup>100</sup>	$\delta$	$\delta$	$\delta$				B2 <sup>2</sup> , 373
d274	—ethyl ester	Ethyl behenate. CH <sub>3</sub> (CH <sub>2</sub> ) <sub>20</sub> CO <sub>2</sub> C <sub>2</sub> H <sub>5</sub>	368.65	nd (al), cr (ace)	50	240–2 <sup>10</sup>	0.8820 <sup>51</sup>		i	s	s				B2 <sup>2</sup> , 374
d275	—methyl ester	Methyl behenate. CH <sub>3</sub> (CH <sub>2</sub> ) <sub>20</sub> CO <sub>2</sub> CH <sub>3</sub>	354.62	nd (ace)	54	224–5 <sup>15</sup>		1.4339 <sup>90</sup>	i	s	s				B2 <sup>2</sup> , 373
Ω d276	1-Docosanol*	Docosyl alcohol. CH <sub>3</sub> (CH <sub>2</sub> ) <sub>21</sub> OH	326.61	(ace, chl)	71 (87)	180 <sup>9,22</sup>			$\delta$	v	$\delta$	$v^a$		chl s MeOH v peth v <sup>a</sup>	B1 <sup>3</sup> , 1846
d277	4,7,11-Docosatrien-18-ynoic acid	Clupanodonic acid. CH <sub>3</sub> (CH <sub>2</sub> ) <sub>2</sub> C=C(CH <sub>2</sub> ) <sub>3</sub> CH=CHCH <sub>2</sub> HO <sub>2</sub> CCH <sub>2</sub> CH=CHCH <sub>2</sub> CH=CHCH <sub>2</sub>	330.52	pa ye $\lambda^{MeOH}$ 240 (4.28), 275 (4.2), 300 (4.2), 328 (4.2), 346 (3.7)	< –78	236 <sup>5</sup>	0.9290 <sup>20</sup>	1.4868 <sup>20</sup>	i		s				C49, 1550
Ω d278	13-Docosenoic acid* (cis)	Erucic acid. CH <sub>3</sub> (CH <sub>2</sub> ) <sub>9</sub> CH=CH(CH <sub>2</sub> ) <sub>11</sub> CO <sub>2</sub> H	338.58	nd (al)	33–4	265 <sup>15</sup>	0.860 <sup>25</sup>	1.4758 <sup>20</sup>	i	s	v			MeOH v	B2 <sup>2</sup> , 445
Ω d279	—(trans)*	Brassicic acid. Brassic acid. Isoerucic acid. CH <sub>3</sub> (CH <sub>2</sub> ) <sub>9</sub> CH=CH(CH <sub>2</sub> ) <sub>11</sub> CO <sub>2</sub> H	338.58	pl (al)	61.5	282 <sup>30</sup>	0.8585 <sup>27</sup>	1.4472 <sup>64</sup>	i	$\delta$	$\delta$				B2 <sup>2</sup> , 447
d280	—anhydride (trans)*	Brassicic anhydride. [CH <sub>3</sub> (CH <sub>2</sub> ) <sub>9</sub> CH=CH(CH <sub>2</sub> ) <sub>11</sub> CO] <sub>2</sub> O	659.15	nd (al), pl (eth, ace, peth)	64	0.835 <sup>70</sup>	1.4366 <sup>100</sup>		i	$\delta$	s	s		peth s	B2 <sup>2</sup> , 448
d281	—13,14-diiodo-, ethyl ester* (trans)	Iodobrassicic acid. CH <sub>3</sub> (CH <sub>2</sub> ) <sub>9</sub> CH=CH(CH <sub>2</sub> ) <sub>11</sub> CO <sub>2</sub> C <sub>2</sub> H <sub>5</sub>	618.43	nd or sc	37 (40)	d			i	s	$v^a$	v	v	chl v	B2 <sup>2</sup> , 448
d282	13-Docosynoic acid*	Behenic acid. CH <sub>3</sub> (CH <sub>2</sub> ) <sub>10</sub> CH(OCH <sub>3</sub> ) <sub>2</sub>	336.57	mcl pr or nd (al)	59.5				i	v	v			chl s	B2 <sup>2</sup> , 462
Ω d282 <sup>1</sup>	Dodecanal*	Lauraldehyde. CH <sub>3</sub> (CH <sub>2</sub> ) <sub>10</sub> CHO	184.33	lf	44.5 (12)	185 <sup>100</sup> 100 <sup>5,5</sup> 132–4 <sup>5</sup>	0.8352 <sup>15</sup>	1.435 <sup>22</sup>	i	s	s			MeOH v	B1 <sup>3</sup> , 2911
d283	—dimethyl acetal	1,1-Dimethoxydodecane*. CH <sub>3</sub> (CH <sub>2</sub> ) <sub>10</sub> CH(OCH <sub>3</sub> ) <sub>2</sub>	230.40						i	v	v	v		chl. CCl <sub>4</sub>	Am 80, 6613
Ω d284	Dodecane*	CH <sub>3</sub> (CH <sub>2</sub> ) <sub>10</sub> CH <sub>3</sub>	170.34		–9.6	216.3 <sup>760</sup> 91.5 <sup>10</sup> 259 <sup>760</sup> 126.5 <sup>10</sup>	0.7487 <sup>20</sup>	1.4216 <sup>20</sup>	i	v	v	v		chl. CCl <sub>4</sub>	B1 <sup>3</sup> , 539
Ω d285	—1-amino*	Dodecylamine. Laurylamine. CH <sub>3</sub> (CH <sub>2</sub> ) <sub>11</sub> NH <sub>2</sub>	185.36		28.3		0.8015 <sup>20</sup>	1.4421 <sup>20</sup>	$\delta$	$\infty$	$\infty$	$\infty$	$\infty$	chl. CCl <sub>4</sub>	B4, 200
d286	—acetate	CH <sub>3</sub> (CH <sub>2</sub> ) <sub>11</sub> NH <sub>2</sub> ·CH <sub>3</sub> CO <sub>2</sub> H	245.41		fr. 69.5				v	v				$\delta$	C48, 2525
d287	—hydrochloride	CH <sub>3</sub> (CH <sub>2</sub> ) <sub>11</sub> NH <sub>2</sub> ·HCl	221.82		98				v	v	i			$\delta$ $s^a$	Am 74, 4287
Ω d288	—1-bromo*	Dodecyl bromide. Lauryl bromide. CH <sub>3</sub> (CH <sub>2</sub> ) <sub>11</sub> Br	249.24		–9.5	276 <sup>760</sup> 139 <sup>10</sup> 85–6 <sup>0,15</sup>	1.0399 <sup>20</sup>	1.4583 <sup>20</sup>	i	s	s	$\infty$			B1 <sup>3</sup> , 542
d289	—1-bromo-12-fluoro*	Fluorododecyl bromide. CH <sub>3</sub> (CH <sub>2</sub> ) <sub>11</sub> Br	267.23					1.4524 <sup>25</sup>	i	v	v	s			CS <sub>2</sub> , 7300
Ω d290	—1-chloro*	Dodecyl chloride. Lauryl chloride. CH <sub>3</sub> (CH <sub>2</sub> ) <sub>11</sub> Cl	204.79		fr. –9.3	260 <sup>760</sup> 126.4 <sup>10</sup>	0.8682 <sup>20</sup>	1.4433 <sup>20</sup>	i	v		$\infty$	s	CCl <sub>4</sub> $\infty$ lig $\infty$	B1 <sup>3</sup> , 541

For explanations, symbols and abbreviations see beginning of table. For structural formulas see end of table.



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## PHYSICAL CONSTANTS OF ORGANIC COMPOUNDS (Continued)

No.	Name	Synonyms and Formula	Mol. wt.	Color, crystalline form, specific rotation and $\lambda_{\text{max}}$ (log $\epsilon$ )	m.p. °C	b.p. °C	Density	$n_D$	Solubility						Ref.
									w	al	eth	ace	bz	other solvents	
2-Nonadecanone															
$\Omega$ n511	2-Nonadecanone*	Methyl <i>n</i> -heptadecyl ketone. $\text{CH}_3(\text{CH}_2)_{16}\text{COCH}_3$	282.52	pl (al)	57	266.5 <sup>110</sup> 165 <sup>2</sup>	0.8108 <sup>50</sup>	.....	i	$\delta$ s <sup>a</sup>	v	s v <sup>a</sup>	...	chl, CCl <sub>4</sub> v to v <sup>a</sup> bz s, v <sup>a</sup>	B1 <sup>2</sup> , 773
n512	—, oxime*	$\text{CH}_3(\text{CH}_2)_{16}\text{C}(\text{NOH})\text{CH}_3$	297.53	cr (al)	76.5–7.5	.....	.....	.....	.....	s <sup>a</sup>	.....	.....	.....	.....	B1, 718
$\Omega$ n513	4-Nonadecanone*	<i>n</i> -Propyl <i>n</i> -pentadecyl ketone. $\text{CH}_3(\text{CH}_2)_{14}\text{CO}(\text{CH}_2)_3\text{CH}_3$	282.52	lf (al)	50.5	211 <sup>11</sup> $\delta$ d	.....	.....	i	$\delta$	v	v	.....	.....	B1 <sup>2</sup> , 773
$\Omega$ n514	10-Nonadecanone*	Caprinone. Dinonyl ketone. $[\text{CH}_3(\text{CH}_2)_4\text{CH}_2]_2\text{CO}$	282.52	lf (al)	65.5 (58)	> 350 155.6 <sup>11</sup>	.....	.....	i	$\delta$ s <sup>a</sup>	s	s	v	chl, lig s	B1, 718
n515	1-Nonadecyne*	$\text{CH}_3(\text{CH}_2)_{16}\text{C}\equiv\text{CH}$	264.50	.....	37–8 (33)	327 <sup>700</sup> 181.6 <sup>10</sup>	0.8054 <sup>20</sup>	1.4488 <sup>20</sup>	.....	.....	s	s	s	.....	B1 <sup>2</sup> , 1030
n516	1,8-Nonadiyne*	$\text{HC}\equiv\text{C}(\text{CH}_2)_3\text{C}\equiv\text{CH}$	120.20	.....	–27.3	162 <sup>700</sup> 55 <sup>13</sup>	0.8158 <sup>20</sup>	1.4490 <sup>20</sup>	.....	.....	s	s	.....	.....	B1 <sup>2</sup> , 1063
$\Omega$ n517	Nonanal*	<i>n</i> -Nonylaldehyde. Pelargonaldehyde. $\text{CH}_3(\text{CH}_2)_8\text{CHO}$	142.24	.....	.....	190–2 93.5 <sup>23</sup>	0.8264 <sup>23</sup>	1.4273 <sup>20</sup>	.....	.....	s	.....	.....	.....	B1 <sup>2</sup> , 761
n518	—, oxime*	$\text{CH}_3(\text{CH}_2)_8\text{CH}(\text{NOH})$	157.26	lf (dil al)	64	.....	.....	.....	i	s	s	s	.....	oss	B1 <sup>2</sup> , 761
$\Omega$ n519	Nonane*	$\text{CH}_3(\text{CH}_2)_8\text{CH}_3$	128.26	.....	–51	150.798 <sup>700</sup> 39 <sup>10</sup>	0.7176 <sup>20</sup>	1.4054 <sup>20</sup>	i	v	v	$\infty$	$\infty$	chl, hp $\infty$	B1 <sup>2</sup> , 502
$\Omega$ n520	—, 1-amino*	<i>n</i> -Nonylamine. $\text{CH}_3(\text{CH}_2)_8\text{CH}_2\text{NH}_2$	143.28	.....	–1	202.2 <sup>700</sup> 80.8 <sup>10</sup>	0.7886 <sup>20</sup>	1.4336 <sup>20</sup>	$\delta$	s	s	.....	.....	.....	B4 <sup>2</sup> , 393
n521	—, 1-chloro*	<i>n</i> -Nonyl chloride. $\text{CH}_3(\text{CH}_2)_8\text{CH}_2\text{Cl}$	162.71	.....	–39.4	203.4 <sup>700</sup> 80.5 <sup>10</sup>	0.8720 <sup>20</sup>	1.4345 <sup>20</sup>	i	.....	s	.....	.....	chl s	B1 <sup>2</sup> , 128
n522	—, 2-chloro*	2-Nonyl chloride. $\text{CH}_3(\text{CH}_2)_7\text{CHClCH}_3$	162.71	.....	.....	190 <sup>700</sup>	0.8790 <sup>20</sup>	1.4420 <sup>20</sup>	i	.....	.....	.....	.....	chl s	B1, 166
n523	—, 5-chloro*	5-Nonyl chloride. $(\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2)_2\text{CHCl}$	162.71	.....	85–7 <sup>14</sup>	0.8639 <sup>15</sup>	1.4314 <sup>15</sup>	.....	i	.....	v	.....	.....	.....	B1 <sup>2</sup> , 128
n524	—, 1-chloro-9-fluoro*	$\text{FCH}_2(\text{CH}_2)_8\text{CH}_2\text{Cl}$	180.70	.....	.....	102–2.5 <sup>11</sup>	0.9662 <sup>20</sup>	1.4301 <sup>25</sup>	i	v	v	.....	.....	.....	CS1, 7300
$\Omega$ n525	Nonanedioic acid*	Azelaic acid. 1,7-Heptanedicarboxylic acid*. $\text{HO}_2\text{C}(\text{CH}_2)_5\text{CO}_2\text{H}$	188.23	lf or nd	106.5	> 360d 287 <sup>100</sup> 225.5 <sup>10</sup>	1.2252 <sup>15</sup>	1.4303 <sup>111</sup>	$\delta$ s <sup>a</sup>	s	$\delta$	.....	$\delta$ v <sup>a</sup>	.....	B2 <sup>2</sup> , 602
$\Omega$ n526	—, dichloride	Azelalyl dichloride. $\text{ClCO}(\text{CH}_2)_5\text{COCl}$	225.12	.....	.....	166 <sup>18</sup> 140 <sup>0.4</sup>	1.4680 <sup>20</sup>	.....	d	d <sup>a</sup>	s	.....	v <sup>a</sup>	.....	B2, 709
$\Omega$ n527	—, diethyl ester*	Ethyl azelate. $\text{C}_2\text{H}_5\text{O}_2\text{C}(\text{CH}_2)_5\text{CO}_2\text{C}_2\text{H}_5$	244.34	$\lambda$ <sup>a</sup> 255 (0.7), 262 (0.8), 273 (0.7)	–18.5	291–2 174–5 <sup>20</sup>	0.97294 <sup>20</sup>	1.43509 <sup>20</sup>	i	s	s	.....	.....	.....	B2 <sup>2</sup> , 603
$\Omega$ n528	—, di(2-ethylbutyl) ester*	Di-2-ethylbutyl azelate. $\text{CH}_3[(\text{CH}_2)_3\text{CO}_2\text{CH}_2\text{CH}(\text{C}_2\text{H}_5)_2]_2$	356.55	.....	–45	230 <sup>3</sup>	0.9282 <sup>15</sup>	1.4432 <sup>15</sup>	i	s	.....	s	s	.....	B2 <sup>2</sup> , 1787
n529	—, di(2-ethylhexyl) ester*	Di-2-ethylhexyl azelate. $\text{CH}_3[(\text{CH}_2)_4\text{CO}_2\text{CH}_2\text{CH}(\text{C}_2\text{H}_5)_2]_2$	412.66	.....	–78	237 <sup>3</sup>	0.9152 <sup>15</sup>	1.4462 <sup>15</sup>	i	s	.....	s	s	.....	B2 <sup>2</sup> , 1787
$\Omega$ n530	—, dimethyl ester*	Dimethyl azelate. $\text{CH}_3\text{O}_2\text{C}(\text{CH}_2)_5\text{CO}_2\text{CH}_3$	216.28	.....	.....	156 <sup>20</sup> 128 <sup>5</sup>	1.0082 <sup>20</sup>	1.4367 <sup>20</sup>	i	s	.....	s	s	oss	B2 <sup>2</sup> , 290
$\Omega$ n531	—, dinitrile	Azelanitrile. $\text{NC}(\text{CH}_2)_5\text{CN}$	150.23	.....	.....	198–9 <sup>23</sup> 160 <sup>3</sup>	0.9290 <sup>100</sup>	1.4518 <sup>19</sup>	i	v	v	.....	v	.....	B2 <sup>2</sup> , 290
n532	—, diphenyl ester*	Diphenyl azelate. $\text{C}_6\text{H}_5\text{O}_2\text{C}(\text{CH}_2)_5\text{CO}_2\text{C}_6\text{H}_5$	340.42	nd (al)	59–60 (49)	.....	.....	.....	i	$\delta$ s <sup>a</sup>	v	.....	v	.....	B6 <sup>2</sup> , 606
$\Omega$ n533	1,9-Nonanediol*	Nonamethylene glycol. $\text{HOCH}_2(\text{CH}_2)_7\text{CH}_2\text{OH}$	160.26	cr (bz)	45.8	173–5 <sup>20</sup>	.....	.....	$\delta$	v	v	.....	s <sup>a</sup>	lig i	B1 <sup>2</sup> , 2226
$\Omega$ n534	Nonanoic acid*	<i>n</i> -Nonylic acid. Pelargonic acid. $\text{CH}_3(\text{CH}_2)_8\text{CO}_2\text{H}$	158.24	.....	fp 12.24 15	255 <sup>700</sup> 150 <sup>20</sup>	0.9057 <sup>20</sup>	1.4343 <sup>19</sup>	i	s	s	.....	.....	chl s	B2 <sup>2</sup> , 360
n535	—, amide	Nonanamide*. Pelargonamide. $\text{CH}_3(\text{CH}_2)_8\text{CONH}_2$	157.26	.....	99.2–9.7	sub	0.8394 <sup>110</sup>	1.4248 <sup>110</sup>	i	$\delta$	$\delta$	.....	.....	.....	B2 <sup>2</sup> , 822
$\Omega$ n536	—, chloride	Nonanoyl chloride*. Pelargonyl chloride. $\text{CH}_3(\text{CH}_2)_8\text{COCl}$	176.69	.....	–60.5	215.35 <sup>700</sup> 98 <sup>15</sup>	0.9463 <sup>15</sup>	.....	d	d	s	s	.....	.....	B2 <sup>2</sup> , 308
$\Omega$ n537	—, ethyl ester*	$\text{CH}_3(\text{CH}_2)_8\text{CO}_2\text{C}_2\text{H}_5$	186.30	.....	–36.7	227 <sup>700</sup> 96–8 <sup>10</sup>	0.8657 <sup>20</sup>	1.4220 <sup>20</sup>	i	s	s	s	.....	.....	B2 <sup>2</sup> , 307
$\Omega$ n538	—, methyl ester*	$\text{CH}_3(\text{CH}_2)_8\text{CO}_2\text{CH}_3$	172.27	.....	.....	213–4 <sup>757</sup> 104–6 <sup>23</sup>	0.8799 <sup>15</sup>	1.4214 <sup>20</sup>	i	s	s	.....	.....	.....	B2 <sup>2</sup> , 307
$\Omega$ n539	—, nitrile	Nonanonitrile*. Octyl cyanide. Pelargonitrile. $\text{CH}_3(\text{CH}_2)_8\text{CN}$	139.24	.....	–34.2	224.4 <sup>700</sup> 91.9 <sup>10</sup>	0.8178 <sup>20</sup>	1.4255 <sup>20</sup>	i	s	s	.....	.....	.....	B2 <sup>2</sup> , 828
n540	—, piperazinium salt	$2[\text{CH}_3(\text{CH}_2)_7\text{CO}_2\text{H}]\cdot\text{C}_4\text{H}_{10}\text{N}_2$	402.62	wh	95.1–6.2	.....	.....	.....	s <sup>a</sup>	s	i	.....	.....	.....	Am70, 2758
n541	—, 9-amino*	$\text{H}_2\text{NCH}_2(\text{CH}_2)_7\text{CO}_2\text{H}$	173.26	.....	185.6–6.6	.....	.....	.....	s	s	.....	.....	.....	.....	B4 <sup>2</sup> , 1479
n542	—, 9-fluoro*	<i>m</i> -Fluoropelargonic acid. $\text{FCH}_2(\text{CH}_2)_7\text{CO}_2\text{H}$	176.23	.....	ca. 18	89–90 <sup>0.2</sup>	1.4289 <sup>25</sup>	.....	$\delta$	v	v	.....	.....	.....	CS2, 1918
$\Omega$ n543	1-Nonanol*	Nonyl alcohol. $\text{CH}_3(\text{CH}_2)_8\text{CH}_2\text{OH}$	144.26	.....	–5.5	213.5 <sup>700</sup> 118 <sup>15</sup>	0.8273 <sup>20</sup>	1.4333 <sup>20</sup>	i	s	s	.....	.....	.....	B1 <sup>2</sup> , 1743
n549	5-Nonanol, 5-butyl*	Tri- <i>n</i> -butyl carbinol. $[\text{CH}_3(\text{CH}_2)_3]_3\text{COH}$	200.37	.....	20	230–5d 118– 20 <sup>17</sup>	0.8408 <sup>20</sup>	1.4445 <sup>20</sup>	i	s	.....	.....	.....	.....	B1 <sup>2</sup> , 1802
n550	1-Nonanol, 9-chloro*	Nonamethylene chlorohydrin. $\text{ClCH}_2(\text{CH}_2)_7\text{CH}_2\text{OH}$	178.71	.....	28	146–8 <sup>14</sup>	.....	1.4575 <sup>20</sup>	i	v	v	.....	.....	.....	CS1, 7300
n551	—, 9-fluoro*	Nonamethylene fluorohydrin. $\text{FCH}_2(\text{CH}_2)_7\text{CH}_2\text{OH}$	162.25	.....	.....	125–6 <sup>15</sup>	0.9282 <sup>20</sup>	1.4279 <sup>25</sup>	i	v	v	.....	.....	.....	CS1, 7300
$\Omega$ n552	2-Nonanone*	Heptyl methyl ketone. $\text{CH}_3(\text{CH}_2)_6\text{COCH}_3$	142.24	$\lambda$ < 200	–7.46	195.3 <sup>700</sup> 73.8 <sup>10</sup>	0.8208 <sup>20</sup>	1.42096 <sup>20</sup>	i	s	s	v	s	chl, MeOH v	B1 <sup>2</sup> , 2887

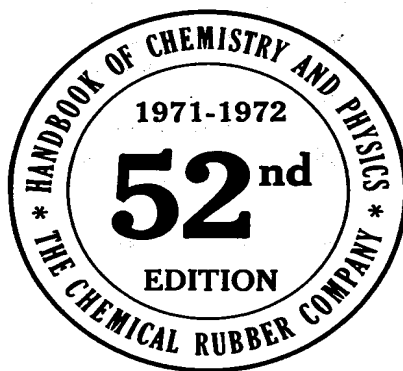
For explanations, symbols and abbreviations see beginning of table. For structural formulas see end of table.

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A Ready-Reference Book of Chemical and Physical Data



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